larger cells become multinucleate. The nuclear divisions are mitotic throughout. The antheridia in all cases are uninucleate. In the forms with exogenous antheridia the uninucleate spermatia arise as branchlike outgrowths from the antheridia. It is probable that the antheridial nucleus divides repeatedly to furnish nuclei for the successively formed spermatia. In the forms with endogenous antheridia, the antheridial nucleus divides and the sperm nucleus is pushed out by the spindle fibers toward the opening of the antheridium through which the spermatia are discharged. The spermatia consist of the relatively large nucleus, apparently surrounded by only a little cytoplasm, and the protoplasmic membrane. The antheridial nucleus divides repeatedly to form successive sperm nuclei which are ejected by the spindle fibers in the peculiar manner described.

The origin of the binucleate state of the carpogenic cell was made out only in *Laboulbenia chaetophora*, which has no antheridia. In the other forms neither the entrance of the sperm nucleus into the trichogyne nor its migration through the trichophoric cell has been observed. In *Laboulbenia chaetophora* the nuclei of the trichophoric and the carpogenic cells divide, and one nucleus from each pair ultimately constitutes a member of the pair in the carpogenic cell. From the carpogenic cell the ascogonium and ascogenous cells are formed after a series of conjugate nuclear divisions. Asci bud off directly from the binucleate ascogenous cells. The subsequent processes of nuclear fusion in the ascus and spore formation differ in no essential detail from the analogous processes among the Ascomycetes with which the Laboulbeniales are usually classed.

The conclusion drawn by the author from the cytological study of the Laboulbeniales is that they belong to the Ascomycetes, and more particularly, on account of the possession of a perithecium, to the Pyrenomycetes. The phenomena occurring in the ascus appear to lend some support to this classification, but the author's attempt to homologize the perithecium of the Laboulbeniales with that of the Pyrenomycetes would seem to need further support. Thus far the unique development of the perithecium of the Laboulbeniales has no known analogies among the Ascomycetes.—H. HASSELBRING.

Sexuality in mosses.—MARCHAL,[27] in a study of sexuality in mosses, makes a comparison of a dioicous species, *Bryum caespiticium*, with a number of synoicous species, chief among which is *Amblystegium serpens*. In the dioicous species one-half of the spores give rise to protonemata which produce antheridial plants, the other half produce archegonial plants. Fertilization produces a bisexual sporophyte and the sex characters are separated in the reduction division. Consequently two members of the tetrad are always male and two female, as has actually been shown in *Sphaerocarpus*. In synoicous forms the

[27] MARCHAL, EL., La sexualité chez les Mousses. Bull. Soc. Roy. Belgique **47**: 277–285. 1911.

gametophores from protonemata produced by spores, as well as those from secondary protonemata rising from the stem, leaves, and even from the wall cells of antheridia and archegonia, are always bisexual, and the sex characters are not separated until the last division of the spermatogenous and the oogenous cells. The sex characters are united by fertilization and not separated in the tetrad. Therefore in dioicous mosses the sex characters are separate in the spores, protonemata, gametophores, sperms, and eggs, but not in the sporophyte; in synoicous mosses the sex characters are separate only in the egg and sperm.

MARCHAL is able to induce apospory in the capsule of *Bryum caespiticium*. Gametophores rising from an aposporous protonema are *always synoicous*, but the eggs are never fertilized. He concludes that dioicous mosses which have become synoicous through apospory are irremediably sterile. In the synoicous *Amblystegium serpens* apospory was also induced, and the resulting gametophores produced eggs capable of being fertilized. In the $4x$ sporophytes from these fertilized eggs, apospory was again induced, but the $4x$ leafy shoots, although exceptionally vigorous, have as yet remained persistently sterile. The same results were obtained in other synoicous species, *Amblystegium subtile*, *Barbula muralis*, and many others which the author does not name. He states that *Ephemerum serratum* and *Funaria hygrometrica* are synoicous. Miss SPEER, working in the Hull Botanical Laboratory, first showed that the latter species is occasionally synoicous. MARCHAL is at present studying a sterile synoicous *Bryum atropurpureum* which he believes is a natural aposporous derivative of the common dioicous form.

There are no illustrations, and no definite information as to how the presence of $2x$ and $4x$ numbers in the aposporous derivatives were proved; nor are the methods for inducing apospory and for continuing the cultures given in detail. It is an admirable piece of much-needed research, but the lack of a definite and detailed statement of methods is a very unfortunate omission, since many investigators look with suspicion on the work of those who are secretive as to methods when fundamental problems are concerned.—W. J. G. LAND.

Phytomyxaceae.—SCHWARTZ, who has recently made several contributions to our knowledge of the parasitic slime molds, gives an account[28] of another form which he found on the roots of *Poa annua* and other grasses. The organism, to which he gives the name *Sorosphaera graminis* without, however, adding a formal diagnosis, is closely related to *S. Junci*, which the author discovered in the roots of sedges. The organism was found most abundant on plants whose roots were hypertrophied by eelworms. It is not usually found, however, in the swollen parts, nor does the organism itself produce any form of hypertrophy. The life-history of *S. graminis* does not

[28] SCHWARTZ, E. J., The life-history and cytology of *Sorophaera graminis*. Ann. Botany **25**:792–797. 1911.